

**PATENT**

**N1085-00195**  
**[TSMC2003-0249]**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re application of: **Ju-Chien Chiang et al.**

Examiner: **A. Markoff**

Serial No.: **10/701,708**

Group Art Unit: **1746**

Filed: **November 5, 2003**

Confirmation No.: **7074**

For: **METHOD FOR CLEANING AN INTEGRATED CIRCUIT DEVICE  
USING AN AQUEOUS CLEANING COMPOSITION**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

**DECLARATION OF JU-CHIEN CHIANG, MING-HUAN TSAI, HUAN-JUST LIN, YUAN-HUNG CHIU AND HUN-JAN TAO UNDER 37 CFR 1.131**

1. We, Ju-Chien Chiang, Ming-Huan Tsai, Huan-Just Lin, Yuan-Hung Chiu and Hun-Jan Tao (collectively, "We") are currently employees of Taiwan Semiconductor Manufacturing Co., Ltd. ("TSMC"), the assignee of the present application.

2. We are joint inventors of the subject matter disclosed in U.S. Patent Application Serial No. 10/701,708, filed November 5, 2003, entitled "Method for Cleaning an Integrated Circuit Device using an Aqueous Cleaning Composition" (the "Application").

3. We submit this Declaration to the United State Patent Office under 37 C.F.R. 1.131 to swear behind U.S. Published Application Nos. 2005/0070120A1 to Barnett et al. and 2005/0048794A1 to Brask et al., which each have a United States effective filing date of August 28, 2003 and which are relied on by the Examiner in the Official Action dated July 6, 2006 in rejecting the pending claims.

4. All of the events outlined below occurred in Taiwan, R.O.C. and after Taiwan, R.O.C. became a WTO country in January 2002.

5. Before August 28, 2003, we conceived of a new method for the cleaning of an integrated circuit substrate, as described in the Application.

6. Prior to August 28, 2003, we reduced to practice our method for the cleaning of an integrated circuit substrate, comprising contacting the integrated circuit substrate with a combination of (a) hydrogen fluoride (HF) and (b) a mixture of hydrogen peroxide ( $H_2O_2$ ) with a compound selected from the group consisting of ammonium hydroxide ( $NH_4OH$ ), hydrochloric acid (HCl) and sulfuric acid ( $H_2SO_4$ ).

7. Prior to August 28, 2003, we understand that TSMC forwarded an invention disclosure record to our patent counsel, for preparation of the Application. The invention disclosure record included a PowerPoint® presentation (the "Presentation") documenting our invention and describing related aspects in reducing the invention to practice. Pages from the Presentation are attached as Exhibit A.

8. The abbreviations in Exhibit A are as follows: "SC1" – mixture of ammonium hydroxide, hydrogen peroxide and water; "SC2" – mixture of hydrochloric acid, hydrogen peroxide and water; "DHF" – dilute hydrogen fluoride; "DIO3" – ozone gas dissolved in deionized water; "STI" – shallow trench isolation.

9. As can be seen in Exhibit A, we tested and demonstrated the workability of our method for the cleaning of an integrated circuit substrate, comprising contacting the integrated circuit substrate with a combination of (a) hydrogen fluoride and (b) a mixture of hydrogen peroxide with a compound selected from the group consisting of ammonium hydroxide, hydrochloric acid and sulfuric acid.

10. We hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Title 18, United States Code, Section 1001, and that such willful false statements may jeopardize the validity of the above-identified application or any patent issuing thereon.

DATE: 2006/09/25

Ju-Chien Chiang

**Ju-Chien Chiang**

DATE: 2006/09/25

Ming Huan Tsai

**Ming-Huan Tsai**

DATE: 2006/09/25

Huan-Just Lin

**Huan-Just Lin**

DATE: \_\_\_\_\_

**Yuan-Hung Chiu**

DATE: 2006/09/25

Yuan-Hung Chiu

**Hun-Jan Tao**

2006/9/25

Hun-Jan Tao

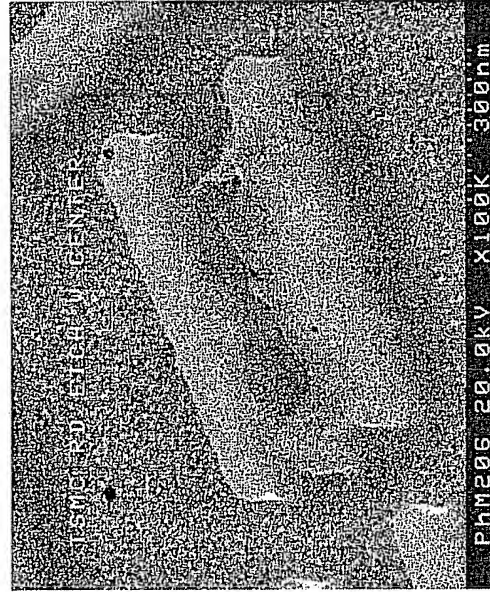
Exhibit A: PowerPoint® presentation



# High K polymer clean

Chemistry: combination of SC1, SC2, DHF and so on.  
Megasonic physical clean

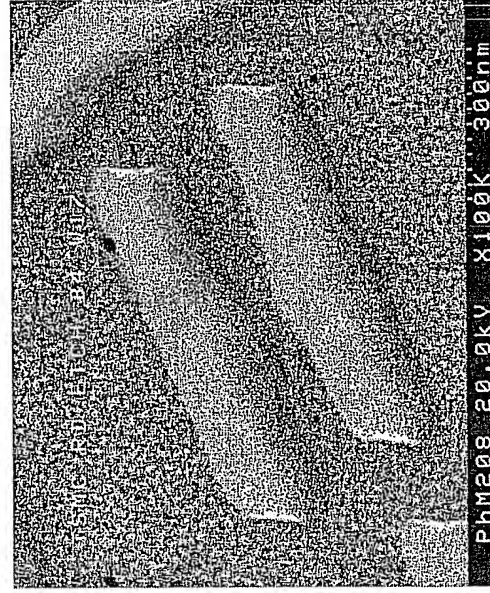
Pre-clean



ADETECH

HULina

Post-clean



Empowering Innovation



# High K polymer clean background

Old method: N/A

Advantages of this invention:

1. Provide a new process flow for high k material removal.
2. Good control of Si recess and STI oxide loss.
3. Free of metal cross contamination.
4. Free of poly gate damage.

In this invention, several chemical steps combined with physical clean equipment are applied for high k polymer clean.

Chemistry: combination of DHF, DIO<sub>3</sub>, H<sub>2</sub>O<sub>2</sub>, SC1, SC2, H<sub>2</sub>SO<sub>4</sub> and so on.

Megasonic function for efficient clean.



Ju-Chien Chiang

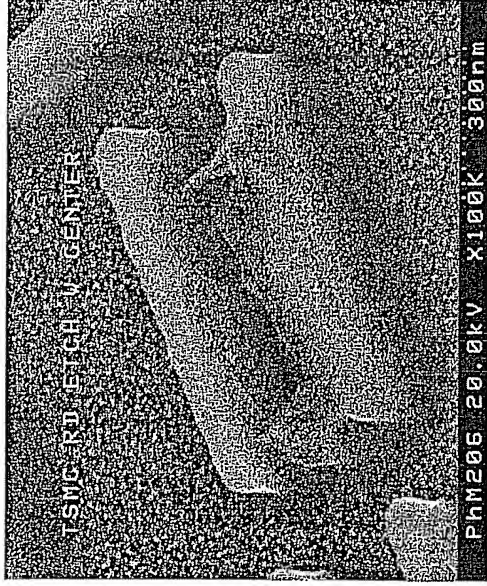
Empowering Innovation



# High K polymer clean results

An example of clean results which used SC1/SC2 chemistry with low power megasonic physical clean is shown as follows:

Before clean



Post clean

